(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 172 273 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
16.01.2002 Bulletin 2002/03

(51) Int Cl.7: B61B 1/00

(21) Application number: 01116627.9

(22) Date of filing: 12.07.2001

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: 14.07.2000 JP 2000213837
19.09.2000 JP 2000282893

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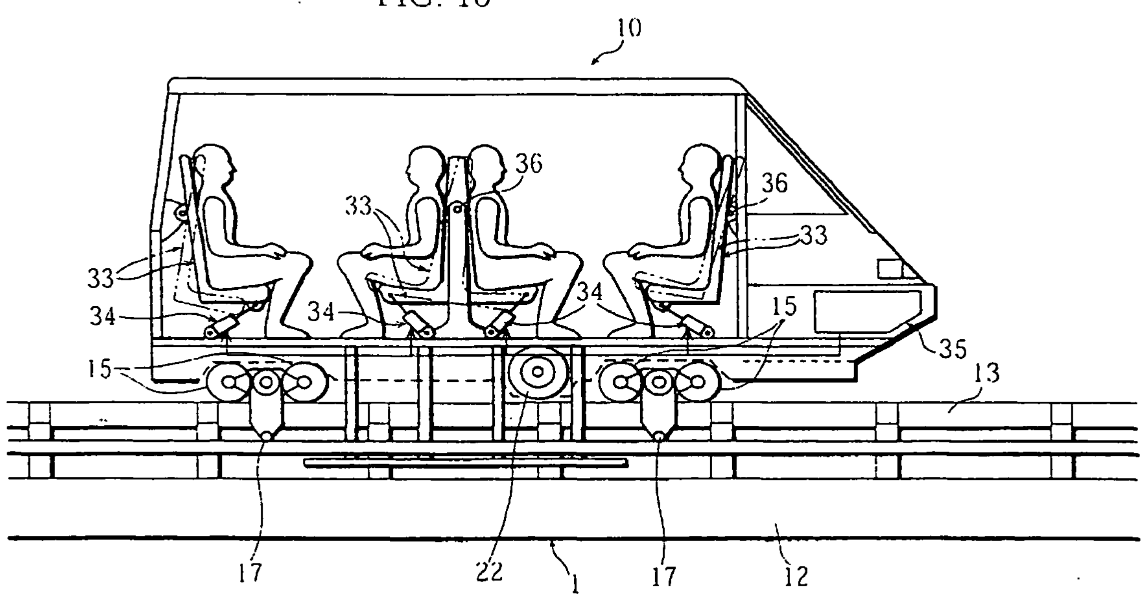
(54) Passenger transportation system

(57) A track (1) has an acceleration zone (A) and an inertial running zone (S). The acceleration zone (A) is to accelerate a car (10) lifted by a lifting apparatus having a stationary power source through a steep down slope. The track (1) is disposed approximately horizontal in the inertial running zone (S) as the car (10) proceeds mainly by inertial running. The car (10) is provided with a seat (33) as to oscillate corresponding to gravity and acceleration of the car (10). A control means (34) to control the oscillation of the seat (33) is provided. The seat (33) oscillates corresponding to gravity and acceleration in lifting by the lifting apparatus and in the acceleration zone (A).

FIG. 10



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Description

[0001] This invention relates to a passenger transportation system.

[0002] As passenger transportation systems for short and medium distance of 5 to 10km, utmost 20km, new transportation system and monorail are known.

[0003] Although there is high demand for the passenger transportation system to link a residential area with a main transportation line, to link plural main transportation lines together, to work as a transportation system within an apartment residential area, to link local airports with city centers, construction of the new transportation system and the monorail above is conducted slower than it was expected.

[0004] Because, firstly, construction cost of the new transportation system and the monorail is extremely high, and secondly, their compositions are too complicated and their performances are excessively high.

[0005] It is an object of the present invention to provide a passenger transportation system of small scale having simple construction, low construction cost, and appropriate performance for short and medium distance. And, it is another object of the present invention to provide a passenger transportation system having comfortable seats even in climbing and descending, and in acceleration and deceleration.

[0006] These objects are solved according to the present invention by passenger transportation system including the features of claim 1, 4, 7, 8, or 11. Furthermore detailed embodiments are described in the dependent claims 2, 3, 5, 6, 9, 10, 12, and 13.

[0007] The present invention will be described with reference to the accompanying drawings in which:

Figure 1 is a front view showing a preferred embodiment of the present invention;
Figure 2 is a front view showing another place for the embodiment of the present invention;
Figure 3 is a front view with a partial cross-section;
Figure 4 is a side view;
Figure 5 is a simplified side view of a principal portion;
Figure 6 is a simplified side view showing another embodiment;
Figure 7 is an explanatory view of a principal portion;
Figure 8 is a front view of a principal portion;
Figure 9 is a front view showing still another embodiment;
Figure 10 is a simplified cross-sectional side view; and
Figure 11 is a block diagram.

[0008] Preferred embodiments of the present invention will now be described with reference to the accompanying drawings.

[0009] In Figure 5, 1 is a track, and 2 indicates a station (platform). The track 1 has an acceleration zone A and an inertial running zone S.

[0010] In the acceleration zone A, as shown in Figure 5, the track 1 is formed into a hill, and the acceleration zone A is composed of a lifting zone A_1 in which a train is lifted by a lifting apparatus having a stationary power source (such as a motor with a speed reducer), and a steep inclination zone A_2 having a steep down slope.

[0011] A ratio (percentage) of a horizontal distance L_1 of the acceleration zone A to an interval L_0 between the station 2 and another station 2 is set to be 2 to 10%.

[0012] Although the track 1 is supported by sufficiently high large supporting legs 3 in the acceleration zone A, the track 1 except in the acceleration zone A is sufficiently close to a ground G and supported by small supporting legs, or touching and disposed on the ground G (without supporting legs).

[0013] The above-mentioned lifting apparatus (not shown in Figures) is composed of a chain and a motor with a speed reducer, or, a rope, a winding device, a motor with a speed reducer, and an elevation stage, or a linear motor.

[0014] A two-dot broken line 4 in Figure 5 shows a comparison example. When the track is disposed for a long distance with a gentle slope as the comparison example, many large supporting legs 3 of various length are necessary, the construction cost becomes enormous, the construction becomes complicated, and the construction work is difficult.

[0015] On the contrary, with the track 1 of the present invention formed as the continuous line in Figure 5, the construction work is remarkably easy and the construction cost can be reduced because the large supporting legs are required only for supporting 2 to 10% of the track 1.

[0016] The ratio is $2\% \leqq (L_1/L_0) \times 100 \leqq 10\%$ because if the ratio is lower than the minimum value (2%), the hill of the acceleration zone A is excessively steep as to increase danger, make passengers anxious, and gain insufficient acceleration. And, if the ratio is more than the maximum value (10%), number of the large supporting legs 3 is unnecessarily large, the construction work is made difficult, and the construction cost is increased thereby.

[0017] A train is immediately lifted from the position of the station 2 to the lifting zone A_1, accelerated through the steep inclination zone (steep down slope) A_2 and running to the right side of Figure 5, inertially running through the approximately horizontal track 1 of the long inertial running zone S without driving, and arrives at next (neighboring) station 2.

[0018] As shown with continuous lines and imaginary lines in Figure 10, a car 10 is provided with seats 33 as to oscillate corresponding to gravity and acceleration of the car 10 and a seat position control means 34 (such as a liquid cylinder and a damper) controlling the oscillation of the seat 33. In the lifting by the lifting apparatus and in the acceleration zone A (refer to Figure 5), the

seat 33 oscillates as to vertically support weight of a passenger with its bearing surface continuously.

[0019] As described above, a seat portion (the bearing surface) and resultant force of gravity and antiacceleration, which is a force in opposite direction to the acceleration and having a magnitude expressed by (mass) × (magnitude of the acceleration), are always at right angles each other. That is to say, as shown in Figure 11, force working on the passenger is detected by a gravity and acceleration detecting means 35, and the seat 33 is oscillated by the seat position control means 34 as the seat portion of the seat 33 is at right angles with the force. And, it is preferable to make the movement gentle with the above-mentioned damper.

[0020] The seat 33 is supported by a supporting point 36 at a position higher than a center of gravity such as the passenger's hip sitting on the seat 33 as to oscillate back and forth. And, the seat 33 in the middle of Figure 10 is inverted T-shaped formed as a passenger sits on one side (proceeding direction side) facing to the proceeding direction, and another passenger sits on the other side (opposite side to the proceeding direction) facing to the opposite direction to the proceeding direction.

[0021] Next, Figure 6 shows the whole of Figure 5 simplified, and a case that another track 5 or a motorway 6 is disposed as to cross (in top view) with and run below the hill-shaped acceleration zone A. That is to say, the space under the hill-shaped acceleration zone A can be artfully used.

[0022] And, collision is prevented by controlling (by a controlling means not shown in Figures) as only one car or one train exists in a section between a top portion 8 of the hill-shaped acceleration zone A and another top portion 8 of a neighboring hill-shaped acceleration zone A.

[0023] An example of the car 10 is shown in Figure 1 through Figure 4. 11 represents a body, and the car ordinarily runs along the track 1 as a train in which plural cars 10 are connected. The track 1 has a main beam 12, two rails 13 of round pipe each of which is disposed over the main beam 12 on the left side and the right side, and a connecting member 14 disposed with a predetermined pitch as to connect the two rails 13.

[0024] The car 10 has upper wheels 15, side wheels 16, and lower wheels 17, which contact each of the rails 13 from upper side, left and right sides, and lower side, and rotate. It can be said that the upper wheel 15 is a main wheel which supports the weight of the car, the side wheel 16 is a side guiding wheel, and the lower wheel 17 is an upstop wheel.

[0025] As shown in Figure 3, the car 10 has a brake plate 18 vertically, and on the other hand, a braking device 19 having brake pads as to clamp the left and right sides of the brake plate 18 is disposed on the track 1 side.

[0026] And, as shown in Figure 3, Figure 7, and Figure 8, a contact face portion 20 (for contact with a driving wheel) is formed with a sheet metal disposed horizontal in longitudinal direction of the track 1, the car 10 is loaded with a small driving motor 21, the driving wheel 22 can be driven to rotate by the small driving motor 21, and the driving wheel 22 freely contacts and parts from the contact face portion 20.

[0027] In Figures, an arm 24 is attached to a lower part of the body 11 as to oscillate around a pivot 23, the small driving motor 21 and the driving wheel 22 are attached to the arm 24, and the arm 24 is oscillated by an actuator 25 such as an air cylinder and an oil-hydraulic cylinder as to be pressed to the contact face portion 20 below for driving the car 10.

[0028] 26 represents a speed detecting device which detects running speed of the car 10 with a pulse signal detector, an encoder, etc. When the running speed becomes lower than a predetermined value, the driving wheel 22 on a raised (parting) position is descended to be pressed to the contact face portion 20 by switching a valve 27, and the car 10 is moved by rotational torque of the driving motor 21. On the contrary, when the running speed goes over the predetermined value, the driving wheel 22 is raised by oppositely switching the valve 27 to part from the contact face portion 20.

[0029] Therefore, when the running speed of the car 10 becomes lower than the predetermined value in the inertial running zone S described with Figure 5, the actuator 25 extends automatically, the arm 24 oscillates downward, and the driving wheel 22 is pressed to the contact face portion 20 on the track 1 side (fixed side) to exceptionally drive the car. For example, the car is driven in an exceptional zone of a range of the mark B in Figure 5.

[0030] Distance and speed of the inertia running of the car 10 after the acceleration in the acceleration zone A depend on weather, number of passengers, and gentle slopes in some cases. In these cases, a small driving means 28 on the car 10 side as shown in Figure 7 and Figure 8 is effective.

[0031] It is also preferable to use the small driving means 28 as an auxiliary driving source in departure from the station 2 and climbing slopes. And, as a braking means in the station 2, the driving motor 21 can be provided with a brake (not shown in Figures), or the driving wheel 22 can be provided with a brake.

[0032] In Figure 3, 29 represents an electric feeding apparatus which is disposed along the track 1. Collecting electrodes on the car 10 side contact the electric feeding apparatus 29 for electric feeding.

[0033] Figure 9 shows another embodiment. In Figure 9, a feeding acceleration zone D is disposed on only a part of the track 1, for example, only near the station 2, and the electric feeding apparatus 29 on the ground side is disposed only in the feeding acceleration zone D. With this construction, the feeding apparatus 29 on the ground (the track 1) side is required only for a short distance, and the construction work can be made easy and the construction cost can be reduced.

[0034] And, using Figure 9, still another embodiment is mentioned. A linear motor is disposed only in the zone D to make a linear motor acceleration zone D and the rest of the track 1 remains as the inertial running zone S. It is also preferable to make the construction work easy and reduce the construction cost with this embodiment.

[0035] And, (although not shown in Figures) in the passenger transportation system, it is preferable that the track 1 are successively sectioned, when a car 10 is detected by a detector in one of the sections, a electricity-cutting safety controlling means certainly prevents a collision by cutting electric feeding in the next section, and, if necessary, several sections neighboring the section to stop another car 10. In this case, the electric feeding apparatus is disposed along the whole of the track 1, and ON-OFF control is independently conducted in each of the sections.

[0036] To add explanations with Figure 1 and Figure 2, the passenger transportation system relating to the present invention is easily applied to a built-up road. That is to say, as shown in Figure 1, a track 1 of round pipe is supported by a supporting leg 32 on a built-up road 30, a median strip 31 of the road 30, and a roadside. With this construction, built-up roads are effectively used, traffic congestion on the roads is alleviated, construction site can be especially small, and the construction cost can be reduced.

[0037] The passenger transportation system relating to the present invention, having the construction described above, is a safe and comfortable passenger transportation, environment-friendly, effective for saving energy, having low construction cost, and appropriate for short and medium distance. And, as shown in Figure 1 through Figure 3, the passenger transportation system is excellent in safety without derailment for the upper wheel 15, the side wheel 16, and the lower wheel 17 embracing the rail 13 of round pipe. And, when the upper wheel 15, the side wheel 16, and the lower wheel 17 are made of elastic material such as rubber, running noise is hardly generated with the inertial running zone S of long distance, and this contributes to reducing traffic noise. And, a linear motor can be used for the lifting zone A_1.

[0038] According to the passenger transportation system relating to the present invention, the system is small-scale with a simple construction and having low construction cost, and appropriate performance for short and medium distance is obtained without overperformance. Especially, the car can be lightweight to contribute to saving energy and resource, and running noise is hardly generated.

[0039] And, although the car 10 having a small and lightweight construction may not gain sufficient speed depending on conditions such as weather and number of passengers, the car 10 is exceptionally accelerated by the small driving motor to perform smooth transportation.

[0040] The track 1 is supported by the large supporting legs 3 not for a long distance as indicated with the two-dot broken line 4 in Figure 5 but for a range of 2 to 10%. This makes the construction work easy and reasonably reduces the construction cost. And, the passengers can taste some excitement.

[0041] And, the passenger transportation system is reasonable as a simple transportation means of small scale, electric feeder is not necessary for long-distance but only for the minimum length. This makes the system excellent in easy construction and reducing the construction cost.

[0042] The hill-shaped acceleration zone A is reasonable to give sufficient potential energy to the car 10, and the construction site is efficiently used with another track 5 and the motorway 6 going through the acceleration zone A.

[0043] And, collision is certainly prevented to enhance safety further.

[0044] And, derailment is effectively prevented to improve safety. The track can be easily disposed on built-up roads.

[0045] And, especially in the lifting (climbing) by the lifting apparatus, the seat oscillates as the seat portion is kept horizontal, the passenger can keep a comfortable posture (without pain). And, sitting comfort is obtained because the seat 33 oscillates and inclines corresponding to acceleration and deceleration as the weight of the passenger works vertically on the bearing face.

[0046] While preferred embodiments of the present invention have been described in this specification, it is to be understood that the invention is illustrative and not restrictive, because various changes are possible within the scope of the invention.

Claims

1. A passenger transportation system comprising a track (1) having an acceleration zone (A) and an inertial running zone (S) , in which a car (10) is lifted by a lifting apparatus having a stationary power source and accelerated through a steep down slope in the acceleration zone (A), and the track (1) is disposed approximately horizontal as the car (10) proceeds mainly by inertial running in the inertial running zone (S).

2. The passenger transportation system as set forth in claim 1, wherein the care (10) is loaded with a small driving motor (21), a driving wheel (22) driven to rotate by the small driving motor (21) is pressed to a contact face portion (20) disposed along the track (1) below a predetermined running speed as to exceptionally drive the car (10) in a part of the inertial running zone (S).

3. A passenger transportation system comprising a track (1) only a part of which is provided with feeding acceleration zone (D) in which a car (10) is accelerated and the rest of the track (1) is an inertial running zone (S) in which the car (10) inertially runs without driving.

4. A passenger transportation system comprising a track (1) provided with two rails (13) of round pipe, and a car (10) having upper wheels (15), side wheels (16), and lower wheels (17) which rotate and contact the rail (13) from an upper side, left and right sides, and a lower side.

5. A passenger transportation system according to claim 1, in which the car (10) is provided with at least one seat (33) as to oscillate corresponding to gravity and acceleration of the car (10) and a control means (34) to control the oscillation of the seat (33), and the seat (33) oscillates corresponding to gravity and acceleration in lifting by the lifting apparatus and in the acceleration zone (A).

6. The passenger transportation system as set forth in claim 5, wherein the car (10) is loaded with a small driving motor (21), a driving wheel (22) driven to rotate by the small driving motor (21) is pressed to a contact face portion (20) disposed along the track (1) below a predetermined running speed as to exceptionally drive the car (10) in a part of the inertial running zone (S).

7. The passenger transportation system as set for in claim 1 or 5, wherein the ratio of horizontal distance (L_1) of the acceleration zone (A), composed of a lifting zone (A_1) in which the car (10) is lifted by the lifting apparatus having a stationary power source and a steep inclination zone (A_2) having a steep down slope, to an interval (L_0) between a station (2) and the next station (2) is set to be 2% to 10%, the track (1) in the acceleration zone (A) is supported by large supporting legs (3), and the track (1) out of the acceleration zone (A) is supported by small supporting legs, or touching and disposed on the ground G without supporting legs.

8. The passenger transportation system as set for in claim 1, 5 or 7, wherein the track (1) is formed into a hill in the acceleration zone (A) as another track (5) or a motorway (6) is disposed between the acceleration zone (A) formed into a hill as to be crossed with the track (1).

9. The passenger transportation system as set forth in claim 1, 5 or 7, wherein the track (1) is formed into a hill in the acceleration zone (A), and collision is prevented by controlling as only one care or one train exists in a section between a top portion (8) of the hill-shaped acceleration zone (A) and another top portion (8) of a neighbouring hill-shaped acceleration zone (A).

10. A passenger transportation system according to claim 3, in which the car (10) is provided with at least one seat (33) to oscillate corresponding to gravity and acceleration of the car (10) and a control means (34) to control the oscillation of the seat (33)

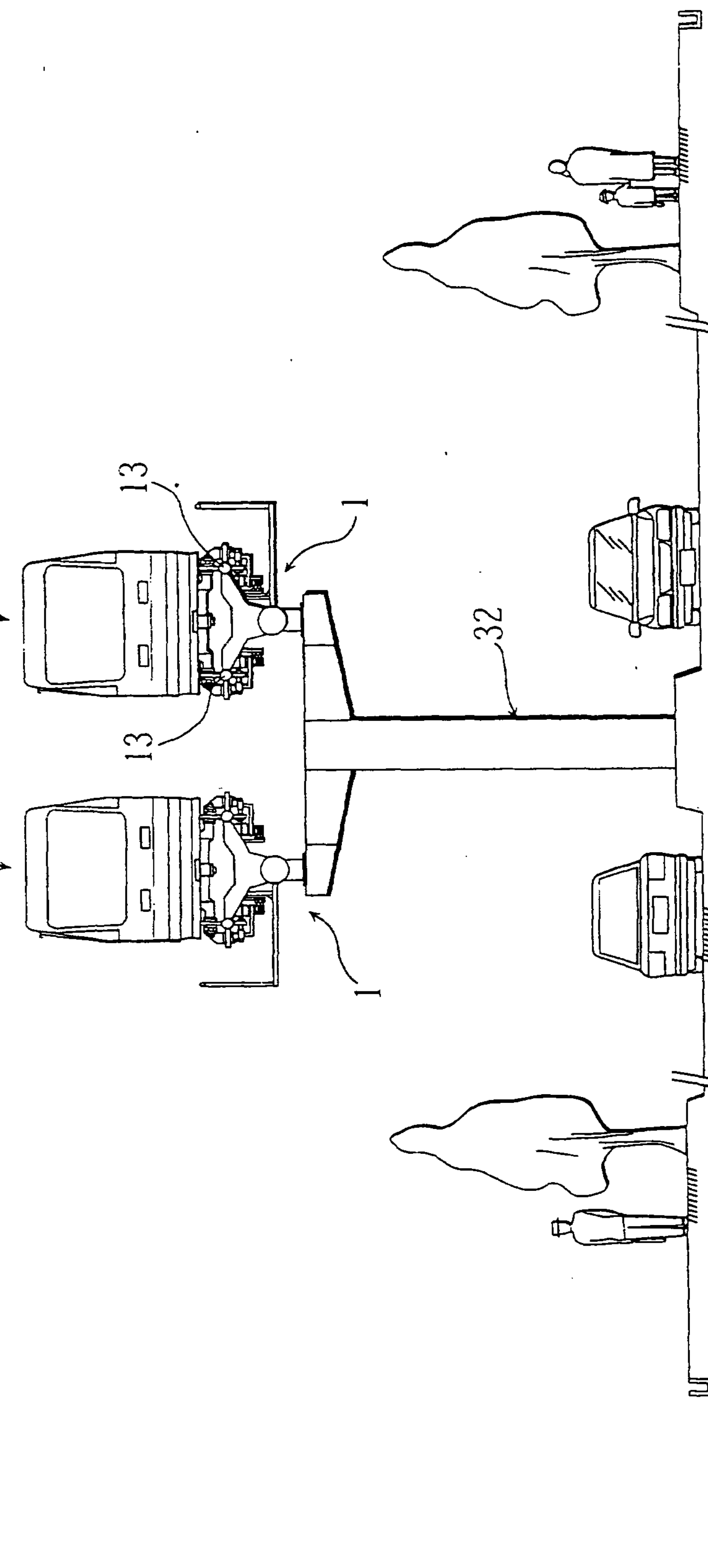


FIG. 1

FIG. 2

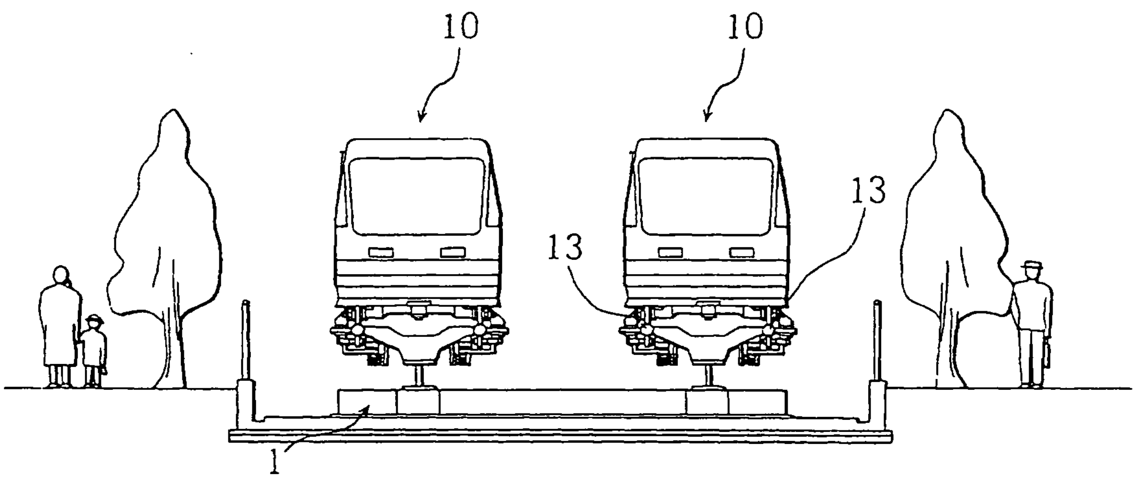
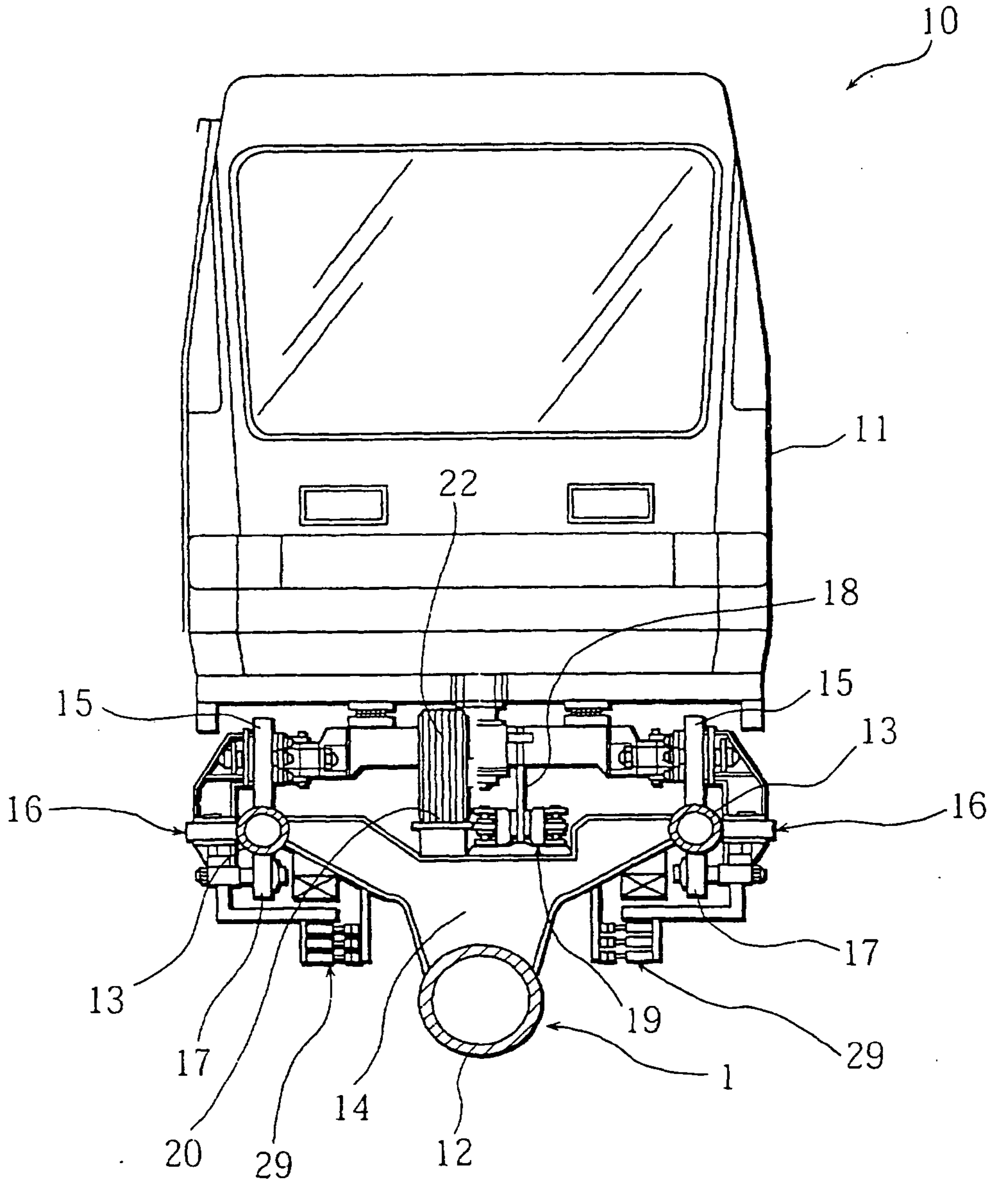


FIG. 3



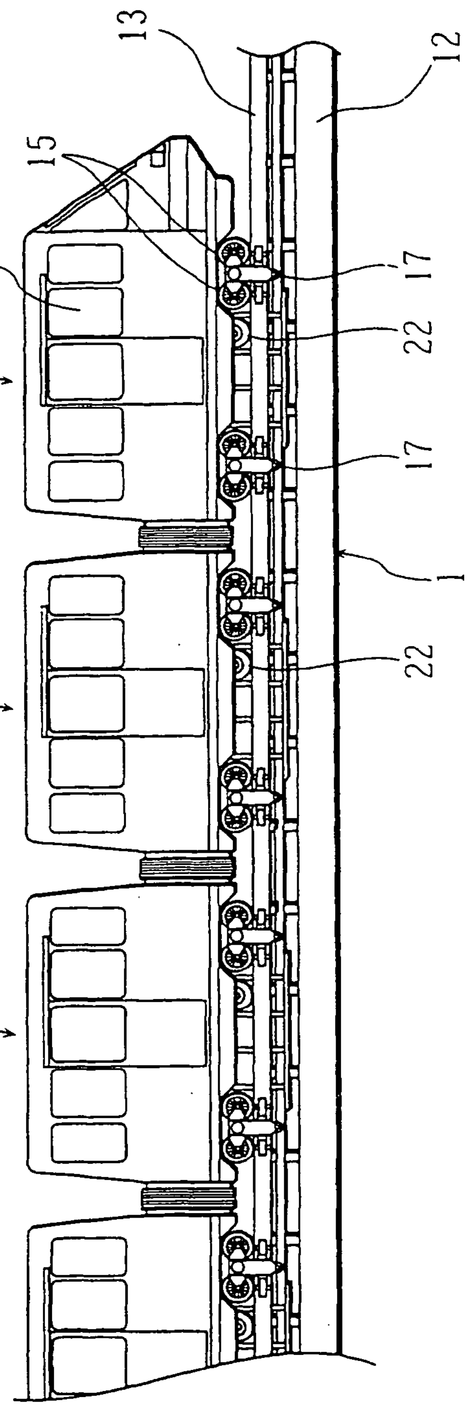
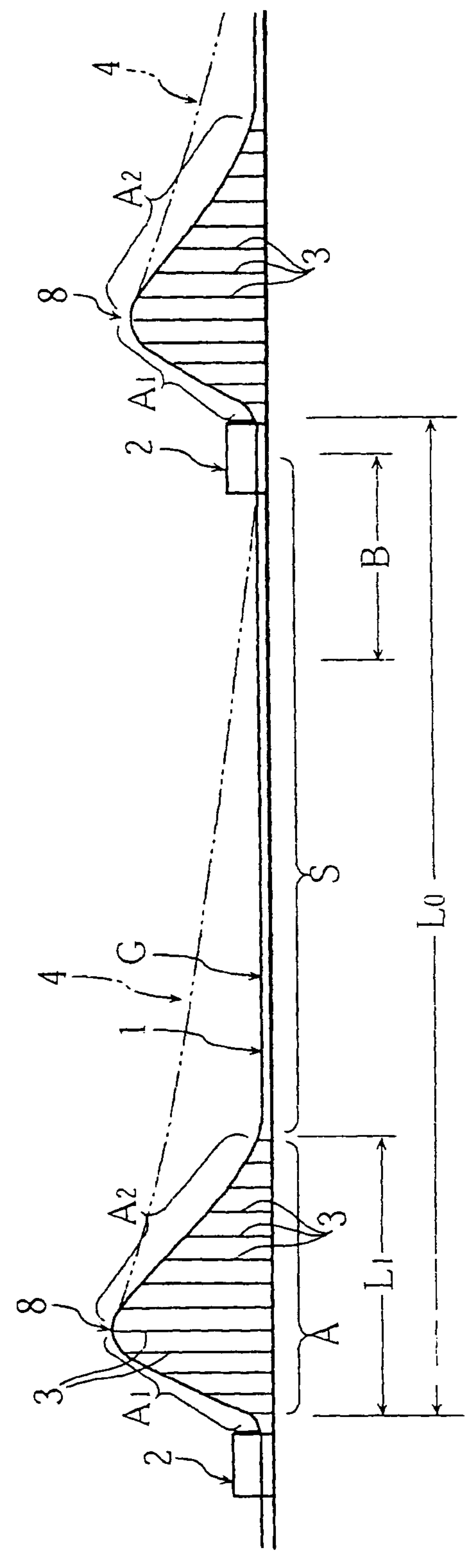


FIG. 4

FIG. 5



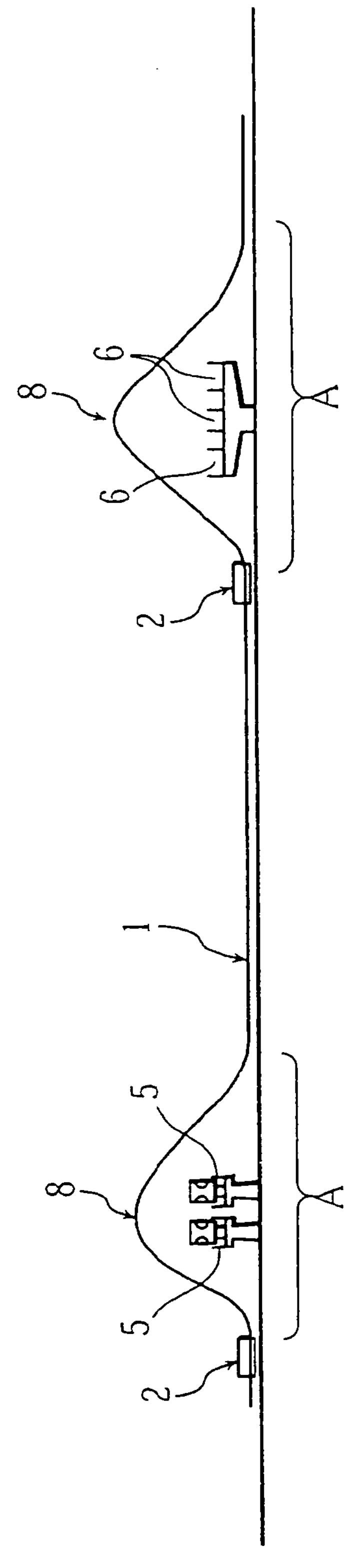


FIG. 6

FIG. 7

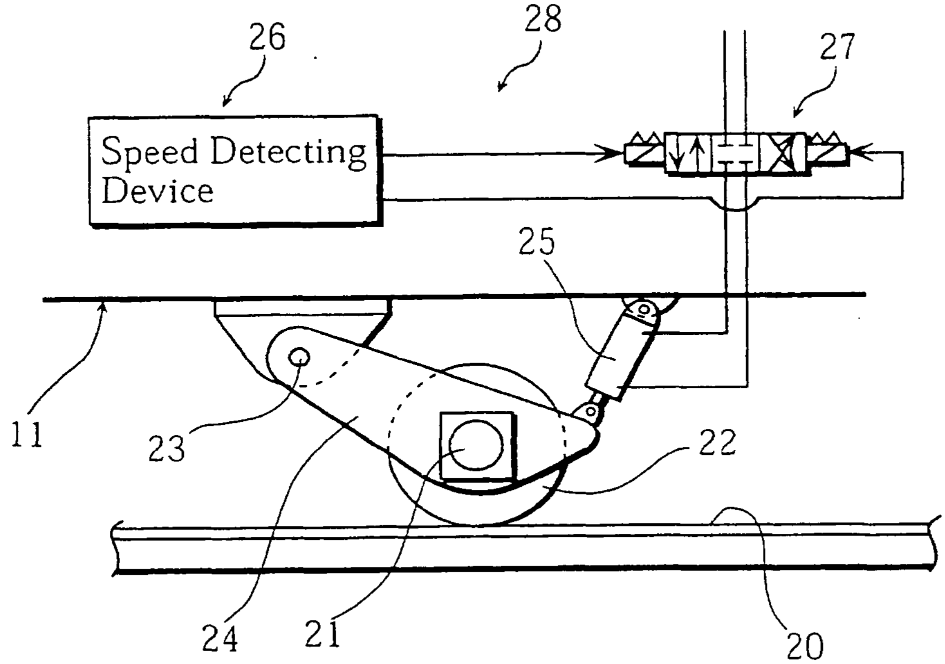


FIG. 8

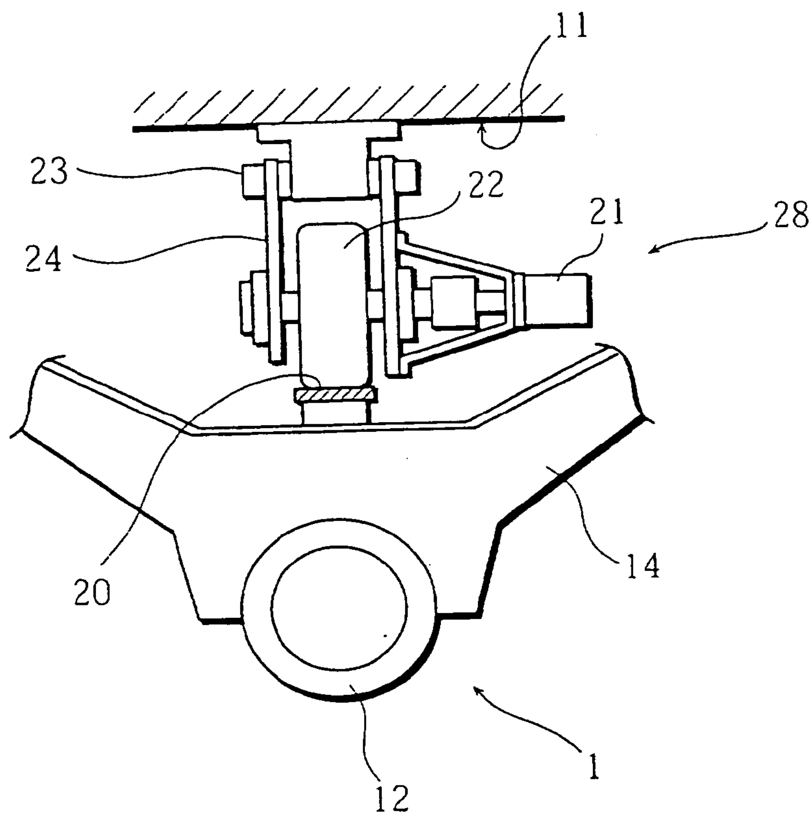


FIG. 9

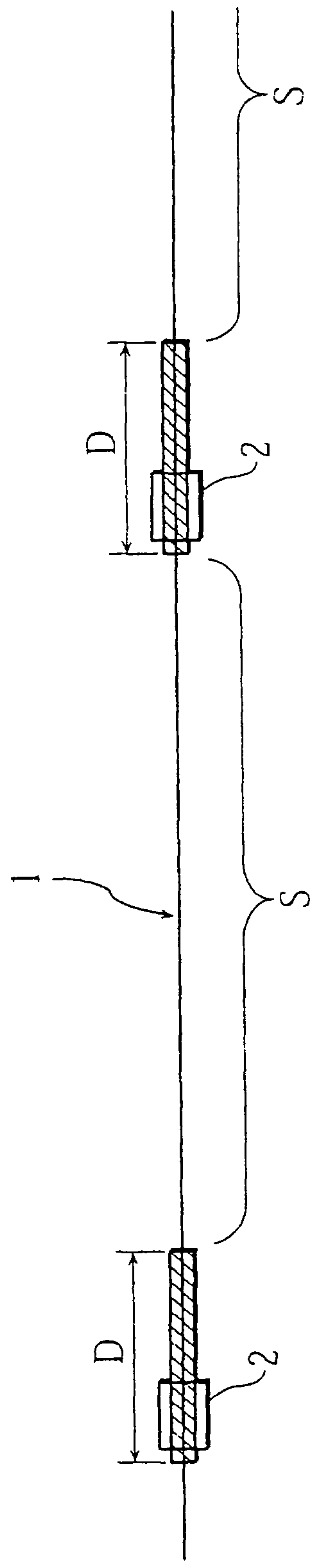


FIG. 10

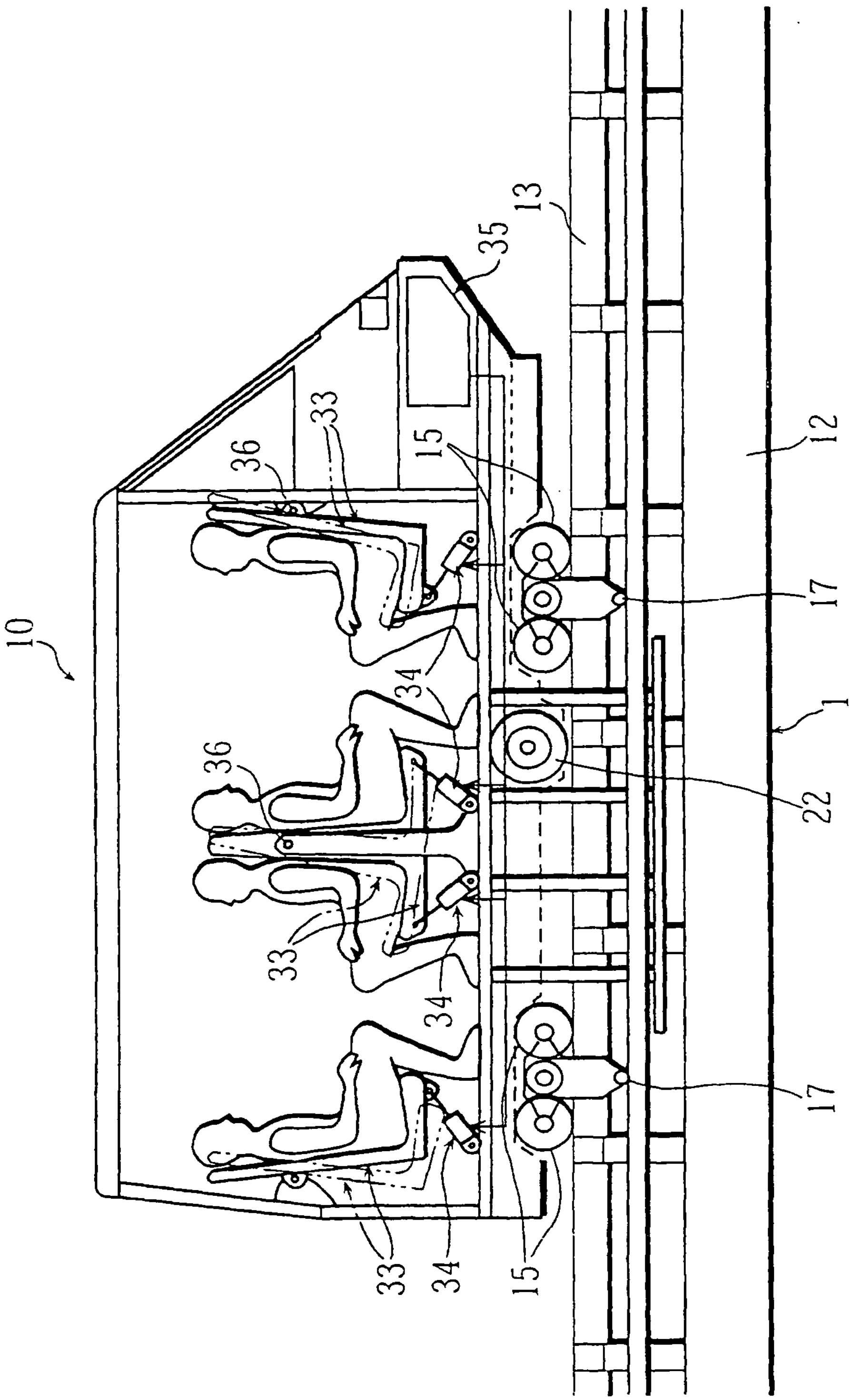
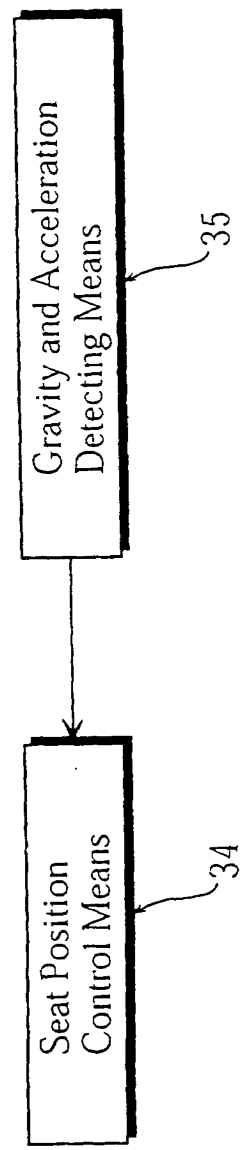


FIG. 11


Gravity and Acceleration
Detecting Means
35
Seat Position
Control Means
34

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EUROPEAN SEARCH REPORT

Application Number
EP 01 11 6627

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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A	WO 00 12350 A (THAU WOLFGANG ;THAU BARBARA (DE)) 9 March 2000 (2000-03-09) * page 9, line 23 - page 10, line 4; figure 6 *	4,5,10	
A	EP 0 940 313 A (VON ROLL SEILBAHNEN AG) 8 September 1999 (1999-09-08) * column 2, line 28 - column 4, line 8; figures 1-5 *	4,5,10	**TECHNICAL FIELDS SEARCHED (Int.Cl.7)** B61B B61C B61J A63G B60N

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	11 October 2001	Chlosta, P

CATEGORY OF CITED DOCUMENTS

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